CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

What is claimed is:

1-36. (Canceled)

37. (Previously Presented) A tubular solid oxide fuel cell assembly comprising:

(a) a tubular, substantially metallic porous support layer; and

(b) a tubular, functional layer assembly in concentric adjacent contact with the support layer, having a wall thickness less than or equal to 80 μm and comprising in concentric arrangement: a ceramic or cermet inner electrode layer, a ceramic middle electrolyte layer, and a ceramic or cermet outer electrode layer;

wherein the support layer has sufficient mechanical strength to support the functional layer assembly, sufficient porosity to allow the flow of a reactant therethrough, and wherein the support layer and functional layer assembly are in mechanical and electrical contact, and the support layer has sufficient

electrical conductivity to collect current during fuel cell operation.

38. (Previously Presented) A tubular solid oxide fuel cell assembly comprising:

(a) a tubular, substantially metallic porous support layer; and

(b) a tubular, functional layer assembly in concentric adjacent contact with the support layer, having a wall thickness less than or equal to 80 μm and comprising in concentric arrangement: a ceramic or cermet inner electrode layer, a ceramic middle electrolyte layer, and a ceramic or cermet outer electrode layer;

wherein the support layer has sufficient mechanical strength to support the functional layer assembly, and sufficient porosity to allow the flow of a reactant therethrough and wherein the electrolyte composition substantially comprises a material selected from the group of yittria-stabilized zirconia and Gd_2O_3 - doped CeO_2 and the electrolyte composition includes at least one sintering additive selected from the group of: cobalt oxide, copper oxide and iron oxide; cobalt, copper and iron; bismuth oxide; bismuth based (Bi-Sr-Ca-Cu-O) ceramic superconductors; and Bi-Sr-Ca-Cu-O.

39. (Previously Presented) A tubular solid oxide fuel cell assembly comprising:

(a) a tubular, substantially metallic porous support layer; and

(b) a tubular, functional layer assembly in concentric adjacent contact with the support layer, having a wall thickness less than or equal to 80 μm and comprising in concentric arrangement: a ceramic or cermet inner electrode layer, a ceramic middle electrolyte layer, and a ceramic or cermet outer electrode layer;

wherein the support layer has sufficient mechanical strength to support the functional layer assembly, sufficient porosity to allow the flow of a reactant therethrough, and a thickness of between 20 and 500 μm, and wherein the support layer composition substantially consists of a material selected from the group consisting of: copper, nickel, copper-alloys, nickel-alloys, copper-nickel mixture, copper/ceramic cermet, copper-alloy/ceramic cermet, copper-nickel/ceramic cermet, copper-silver, and, copper-nickel-silver.

40. (Previously Presented) A tubular solid oxide fuel cell assembly comprising:

(a) a tubular, substantially metallic porous support layer; and

(b) a tubular, functional layer assembly in concentric adjacent contact with the support layer, having a wall thickness less than or equal to 80 μm and comprising in concentric arrangement: a ceramic or cermet inner electrode layer, a ceramic

middle electrolyte layer, and a ceramic or cermet outer electrode layer;

wherein the support layer has sufficient mechanical strength to support the functional layer assembly, and sufficient porosity to allow the flow of a reactant therethrough and wherein the support layer is inside the functional layer assembly and is in contact with the inner electrode layer.

41. (Previously Presented) A tubular solid oxide fuel cell assembly comprising:

(a) a tubular, substantially metallic porous support layer; and

(b) a tubular, functional layer assembly in concentric adjacent contact with the support layer, having a wall thickness less than or equal to 80 μm and comprising in concentric arrangement: a ceramic or cermet inner electrode layer, a ceramic middle electrolyte layer, and a ceramic or cermet outer electrode layer;

wherein the support layer has sufficient mechanical strength to support the functional layer assembly, and sufficient porosity to allow the flow of a reactant therethrough and wherein the functional layer assembly is inside the support layer and the support layer is in contact with the outer electrode layer.

42. (Previously Presented) A method of manufacturing a tubular solid oxide fuel cell assembly comprising:

(a) coating a tubular substantially metallic support layer with a ceramic or cermet inner electrode layer;

(b) coating the inner electrode layer with a ceramic electrolyte layer;

(c) coating the electrolyte layer with a ceramic or cermet outer electrode layer; then

(d) sintering the layers to produce a hollow tubular metal-supported fuel cell;

the electrode and electrolyte layers having a collective wall thickness of 80 μm or less, the support layer having sufficient mechanical strength to support the electrode and electrolyte layers and sufficient porosity to flow a reactant therethrough, wherein the metal support layer includes combustible additives, and wherein in step (d), the combustible additives are combusted thereby producing a porous metal support layer.

43. (Previously Presented) A method of manufacturing a tubular solid oxide fuel cell assembly comprising:

(a) coating a tubular substantially metallic support layer with a ceramic or cermet inner electrode layer;

(b) coating the inner electrode layer with a ceramic electrolyte layer;

(c) coating the electrolyte layer with a ceramic or cermet outer electrode layer; then

(d) sintering the layers to produce a hollow tubular metal-supported fuel cell;

the electrode and electrolyte layers having a collective wall thickness of 80 μm or less, the support layer having sufficient mechanical strength to support the electrode and electrolyte layers and sufficient porosity to flow a reactant therethrough, wherein at least one of the electrode layers includes combustible additives, and wherein in step (d) the combustible additives are combusted thereby producing an electrode layer with increased porosity.

44. (Previously Presented) A method of manufacturing a tubular solid oxide fuel cell comprising:

(a) coating a combustible non-conductive substrate member with a conductive substrate layer;

(b) coating the substrate layer with an inner electrode layer by electrophoretic deposition;

(c) coating the inner electrode layer with an electrolyte layer;

(d) coating the electrolyte layer with an outer electrolyte layer; then

(e) drying and sintering the layers such that the substrate member combusts, thereby producing a hollow tubular fuel cell;

wherein the conductive substrate layer substantially comprises a non-combustible metal and a combustible additive, and

wherein sufficient conductive substrate layer material is applied to provide the conductive substrate layer with sufficient mechanical strength to support the electrode and electrolyte layers during the fuel cell operation, and wherein during sintering, the combustible additive combusts thereby producing a porous metal support layer.

45. (Previously Presented) A method of manufacturing a tubular solid oxide fuel cell comprising:

(a) coating a combustible non-conductive substrate member with a combustible conductive substrate layer;

(b) coating the substrate layer with an inner electrode layer by electrophoretic deposition;

(c) coating the inner electrode layer with an electrolyte layer;

(d) coating the electrolyte layer with an outer electrolyte layer; then

(e) drying and sintering the layers such that the substrate member and the substrate layer combust, thereby producing a hollow tubular fuel cell.

46. (Previously Presented) The method of claim 45 wherein between steps (a) and (b), the conductive substrate layer is coated with a substantially metallic support layer by electrophoretic deposition, the metallic support layer having sufficient mechanical strength to support the electrode and

electrolyte layers during fuel cell operation, and sufficient porosity to enable the flow of a reactant therethrough.

47. (Previously Presented) The method of claim 45 further composing coating the outside electrode layer with a substantially metallic support layer to produce a porous, substantially metallic support layer having sufficient mechanical strength to support the electrode and electrolyte layers during fuel cell operation, and sufficient porosity to enable the flow of a reactant therethrough.

48. (Previously Presented) The method of claim 45 wherein sufficient electrode material is applied to produce an electrode-supported fuel cell.

49. (Previously Presented) A method of manufacturing a tubular solid oxide fuel cell comprising:

(a) coating a combustible non conductive substrate member with a polymer binding solution to enhance the smoothness and reduce the porosity of the substrate surface;

(b) applying a conductive substrate layer onto the polymer coated substrate member;

(c) coating the conductive substrate layer with an inner electrode layer by electrphoretic deposition;

(d) coating the inner electrode layer with an electrolyte layer;

(e) coating the electrolyte layer with an outer electrode layer; then drying and sintering the layers such that the substrate member combusts, thereby producing a hollow tubular fuel cell.